practical scale is published for the benefit of young engineers and amateurs. The *Model Engineer and Amateur Electrician* forms the medium for enthusiastic students fond of engineering, and we find in its columns practical working drawings and photographs contributed and explained in a very lucid manner. Under the heading of "Queries and Replies," readers in difficulty for information get their wants adequately supplied in a subsequent issue. A good example of this is found on p. 165 (April number), where a working general arrangement of a model locomotive is given for a two and a half-inch gauge railway and drawn to a scale of half inch to a foot, in the design of which we notice water tubes placed inside and across the firebox, an idea only introduced into actual locomotive practice a few months ago. Electricity and petrol motors also form an important part within the columns of the periodical, practical types of dynamos, motors, &c., being thoroughly dealt with. A paper of this description brings within the scope of students a practical application of science to mechanical engineering, enabling them to grasp the fundamental ideas of construction and also to carry them through into a practical working form.

IN the article by Sir Michael Foster, on the Regina Margherita Observatory, in last week's NATURE (p. 569), the height of the Gnifetti hut, given as 4560 feet, should be 4560 metres; the height in feet is 14,961.

SEVEN volumes belonging to the valuable "Scientia" series have been received from the publisher, M. C. Naud, of Paris. Six of the volumes (Nos. 13–18) are in the physical section of the series, and one (No. 12) is in the biological section. Each volume may be described as a short review of knowledge of the subject with which it deals, or a statement of observations and results interpreted in the light of recent scientific thought. The titles and authors of the volumes which have just come to hand are "Cryoscopie," by the late M. F. M. Raoult; "Franges d'interférence," by Prof. J. M. de Lépinay; "La Géométrie non-euclidienne," by M. P. Barbarin; "Le Phénomène de Kerr et les Phénomènes électro-optiques," by M. E. Néculcéa; "Théorie de la Lune," by Prof. H. Andoyer; "Géométrographie, ou Art des Constructions géométriques," by M. E. Lemoine; and "L'Hérédité acquise: ses conséquences horticoles, agricoles, et medicales," by M. M. J. Constantin.

THE additions to the Zoological Society's Gardens during the past week include a Campbell's Monkey (*Cercopithecus campbelli*), a Hocheur Monkey (*Cercopithecus nictitans*) from West Africa, presented by Captain Joseph C. Verey; a Sooty Mangabey (*Cercocebus fuliginosus*) from West Africa, a Black-headed Lemur (*Lemur brunneus*), a Red-fronted Lemur (*Lemur rufifrons*) from Madagascar, two King Penguins (*Aptenodytes pennanti*), a Thick-billed Penguin (*Eudyptes pachyrhynchus*) from the Macquarie Islands, two Common Rheas (*Rhea americana*) from the Argentine Republic, a Raven (*Corvus corax*) European, two Eupatorian Parrakeets (*Palaeornis eupatria*), three Indian Rat Snakes (*Zamenis mucosa*), five Tigrine Frogs (*Rana tigrina*) from India, deposited.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN MAY.

May 1. 1h. Jupiter in conjunction with moon. Jupiter 5° 59′ S.
1. 13h. 12m. to 14h. 7m. Moon occults c' Capricornii (mag. 5·2).
4. 5h. Venus in conjunction with moon. Venus 4° 19′ S.
7. Sun partially eclipsed, invisible at Greenwich.
14. 12h. 9m. Minimum of Algol (β Persei).
15. Venus. Illuminated portion of disc = 0·589, of Mars = 0·996.
17. 8h. 58m. Minimum of Algol (β Persei).
May 20. Saturn. Outer minor axis of outer ring = 14″·84.
20. 13h. 18m. Moon makes a near approach to α Libræ (mag. 3).
26. 20h. Saturn in conjunction with moon. Saturn 5° 18′ S.
28. 6h. Mercury at greatest elongation, 23° 3′ E.
28. 12h. Jupiter in conjunction with moon, Jupiter 5° 57′ S.
29. 4h. Mercury in conjunction with Neptune. Mercury 2° 52′ N.

COMET 1902 *a* (BROOKS).—The discovery of the first new comet of the present year was made by Mr. Brooks at Geneva on April 15, and the following data are supplied for the position at discovery and various subsequent epochs:—

1902.	h.	m.	Place.	R.A. °	′	″	N.P.D. °	′	″	Observer
April 15	16	0	Geneva	347	2	0	62	35	0	Brooks.
,, 16	14	37	Kœnigsberg	348	55	16	63	53	25	—
,, 16	15	8·1	Copenhagen	349	3	12	63	58	39	Pechüle.
,, 16	15	30·2	Bamberg	349	6	54	64	1	1	Hartwig.
,, 16	15	45·6	Lick	350	16	56	64	47	34	Aitken.

The original announcement of discovery described the comet as being bright, with a tail. A later description by Prof. Hartwig states that the comet is about 8·5 magnitude, circular in form with a diameter of 3′. There is a central condensation and a tail somewhat less than 30′ in length.

At discovery the new comet was quite close to β Pegasi; it is now moving to the south-east rather rapidly.

NEBULÆ AND THEIR VELOCITIES IN THE LINE OF SIGHT.—Dr. J. Hartmann, of the Potsdam Observatory, gives (*Sitzungsberichte der Kön. Preuss. Akad. der Wissenschaften zu Berlin*, February 27, 1902) an interesting account of his investigation to determine the velocities in the line of sight of several gaseous nebulæ, the spectra of which he has photographed. The work was suggested to him after he had secured a very strong image of the planetary nebula G.C. 4390 with the Potsdam photographic refractor of 80 cm. in the short time of exposure of 15 minutes. In the investigation two spectroscopes were employed, that which he designates apparatus I. consisting of a flint glass prism of 60°, a collimator of 530 mm. and a camera of 720 mm. focal lengths; while apparatus III. has three flint glass prisms of 63°, a collimator of 480 mm. and a camera of 410 mm. focal lengths. The exposures of the different negatives obtained varied from 90 to 270 minutes, and the comparison spectrum photographed in each case was that of the arc spectrum of iron; the nebulæ photographed and the spectra of which were examined for movement in the line of sight were G.C. 4390, 4373, and N.G.C. 7027. Dr. Hartmann determined first of all the velocity of the nebula G.C. 4390 from the measurements of the hydrogen lines Hβ and Hγ, and from this value deduced the wave-lengths of the two chief nebula lines. All the values for the velocity as determined from the different negatives agreed well among themselves, and the deduced mean values for the wave-lengths of the two nebula lines were 5007·04 and 4959·17. While the former value is practically identical with the wave-length obtained by Prof. Keeler for the Orion nebula 5007·05 ± 0·03, the latter is somewhat greater than Keeler's value, namely 4959·02 ± 0·04. Dr. Hartmann finds that the discrepancy is easily explained, as Keeler used a spark spectrum of iron for comparison, and the two lines of iron close together at this wave-length behave differently under the two electrical conditions (arc and spark). If it be assumed that Keeler's comparison line was that at wave-length 4957·78 instead of at 4957·63—and Dr. Hartmann seems to have good reasons for making this assumption—then his own result is brought in complete accord. The paper further gives details of each of the measurements on the different photographic negatives employed, but the following table shows only the mean results obtained, giving Keeler's values for comparison:—

Nebula	Velocity Hartmann km.	Keeler km.
G.C. 4390 ...	−10·5	−9·7
G.C. 4373 ...	−65·8	−64·7
N.G.C. 7027 ...	+4·9	+10·1

It is interesting to note that Dr. Hartmann finds slightly different values of the velocity for the middles in relation to the

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edges of the nebulæ; and the curved and inclined nature of the lines, when compared with those in the comparison spectra, indicate still more clearly relative movements in the nebulæ themselves.

THE RED SPOT ON JUPITER.—In the *Astronomische Nachrichten* (Bd. 158, No. 3786), Mr. A. Stanley Williams gives a discussion of his observations of the red spot on Jupiter during 1901. The planet was badly placed owing to its great southerly declination, but during the summer months the definition was exceptionally good. Tables are given of the times occupied in the transit of the spot over the mean meridian of the disc, measures being taken from both the middle and following end of the marking. The mean rotation period thus determined is 9h. 55m. 40·92s., which is 1·38s. shorter than the value deduced from the observations of the previous year. This shortening of the length of the rotation period has also been noted by several other observers. In appearance the spot was very faint, especially at the preceding end. The following extremity, however, was fairly dark; a distinct though faint reddish tinge was generally noticeable.

Several reductions of measures of the length of the spot are given as evidence in favour of Prof. G. W. Hough's statement that the spot has not materially changed in size during the last twenty years.

THE MEANING OF THE WHITE UNDER SIDES OF ANIMALS.

PROF. E. B. POULTON has sent us the following account of a discovery of great interest to naturalists made by Mr. A. H. Thayer, and a paper in which Mr. Thayer himself describes his observations and conclusions. This paper has been specially revised for publication in NATURE, and with Prof. Poulton's introduction will be welcomed by many observers of nature.

No discovery in the wide field of animal coloration has been received with greater interest than Mr. Abbott H. Thayer's demonstration, by means of models presented to the Natural History Museums of London, Oxford and Cambridge, of the cryptic effect of the gradation of animal tints, from dark on the back to white on the belly. In spite of the intense interest aroused in students of animal life from the side of art as well as from the side of zoological science, the underlying principles have been frequently misunderstood.

Mr. Thayer has seen some of the accounts of his discovery which have appeared in this country, and he feels that the explanation offered has been inadequate and sometimes misleading. He has therefore sent for publication in NATURE a further statement, which may be regarded as an appendix to his original memoirs in *The Auk* for April and October, 1896. In this statement he makes a too generous acknowledgment of my partial discovery of the same principle (unknown to him in 1896) in two isolated cases in 1886 and 1887. I should wish, therefore, to state that I did not discover, and could never have discovered, what it required the eye of an artist to see—viz. the manner in which the total colour-effect of the cold white under side of an animal bathed in shadow and yellow earth reflections matches exactly its earth-brown back bathed in the cold blue-white of the sky. I furthermore failed to see the wide application of that part of the principle which I did discover, and not only failed to see it, but actually applied to the white under sides of animals and the white eggs of certain birds the erroneous interpretation which was then commonly received, the interpretation which Mr. Thayer disposes of so completely in the article printed below.

The following account was drawn up by the present writer for the models presented by Mr. Thayer to the Oxford University Museum. It is believed that the description of the principles concerned may be useful to students in other museums. I should add that Mr. Thayer cordially approves this description of the principles he has discovered:—

"Motiels to show the manner in which wild animals are commonly hidden.

"Made and presented by Abbott H. Thayer, Esq., of Scarbro, N.Y., U.S.A.

"If the two model ducks in this case be looked at from a little distance, the left-hand model will appear almost invisible, transparent and ghost-like, while the right-hand one stands out in startling contrast. The former has a colour arrangement similar to that commonly found among wild animals in nature, while the latter is entirely different.

"There are two quite distinct elements in the concealment of the left-hand model, and of such an animal as a hare or a woodcock. First there is loss of all appearance of *solidity*, secondly there is the harmony with the *colour* of the background.

"We are led to believe that any small object is *solid* and possesses a definite shape solely because of the varying depth of shade on parts of its surface more or less shielded from light. (In the case of a very large object, such as a mountain, the adjustment required when the eye focusses its near and distant parts may also aid the judgment, but this could not apply to anything so small as an animal). Thus an artist can make an object on the flat surface of his canvas appear to stand out as a solid because he paints the shadows as they would be caused by the varying degree of light on the surface of a solid. Mr. Thayer has shown for the first time that the opposite operation is quite possible, viz. that an artist can paint a solid object so as to obliterate the shadows and as a result to remove all appearance of solidity. In the case of an object illuminated, as animals are in nature, by the direct and reflected light of the sky, this is achieved by colouring the object darkest on the top where the light is strongest, gradually less dark on the sides where the light progressively lessens, and white underneath where the light is least, the darkening of the colour corresponding exactly to the strengthening of the illumination. This will be seen at once by turning the handle at the side of the case. The right-hand model is, on the other hand, of uniform colour, and appears far darker on the sides than the back, and darker still, almost dead black, underneath.

"In fact the model which is the same shade of colour all over appears to be a different shade everywhere because of the difference in illumination; while the model which is of a different shade at every level appears to be the same shade all over because the differences of shade exactly counterbalance the differences of illumination.

"Animals in nature are commonly graded in colour like the left-hand model; and Mr. Thayer's discovery of this great and yet simple principle was made because he, as an artist, recognised the ghost-like appearance of wild animals and then set to work to analyse its cause.

"But the obliteration of solidity would not effectually conceal if the *colour* did not harmonise with the environment. The back of the model, and of animals generally, is of the same tint as the brown of the earth bathed in the cold blue-white light of the sky; the under side of the model and the belly of animals is of a cold blue-white bathed in shadow and yellow earth reflections. These two mixtures produce colour effects which are similar to each other and to the mixtures of intermediate components on the sides.

"Hence with *solidity* eliminated and with *colour harmony* between environment and object, the latter appears to be but a part of the former. It is thus possible to explain the concealment of the left-hand model, or of such an animal as the hare crouching motionless on bare earth, or the numerous sand-coloured quadrupeds, birds and reptiles of the desert; but upon the surface of most animals markings are added which suggest the details of a more varied environment, such as that presented by masses of brown leaves, twigs, reeds, grasses, lichen, &c. It is obvious that in an environment full of varied detail a colouring producing a uniform effect would not conceal; hence the markings on the woodcock, ptarmigan, &c. In such cases the animal itself appears to become part of the background while its markings are seen as the details.

"Mr. Thayer has also gained further proof of the accuracy of his interpretation by painting out the gradation of colour on the sides and belly of a stuffed bird, thus extending the colour of the back over all parts of the surface. Although a living bird with its natural colouring would be almost invisible in nature, the painted specimen became extremely conspicuous when placed in the natural attitude and amid natural surroundings.

"It is not too much to assert that the broad fact of the colour gradation on the sides of animals passing into white underneath has now for the first time received its interpretation. "EDWARD B. POULTON.

"Oxford, January 22, 1902."

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